CLAIMS

What is claimed is:

1. A microarray print head, said print head comprising:

a plurality of glass or quartz spotting capillaries disposed in a support that maintains a fixed spacing between said spotting capillaries and that permits the spotting capillaries to move in a direction parallel to the long axis of said capillaries.

2. The print head of claim 1, wherein said spotting capillaries have a tapered tip.

3. The print head of claim 2, wherein said tapered tip is ground.

4. The print head of claim 1, wherein a capillary comprising said print head has maximum load volume of about 0.5 μL.

5. The print head of claim 1, wherein a capillary comprising said print head has a minimum load volume of about 0.05 μL.

6. The print head of claim 1, wherein a capillary comprising said print head has a load volume of about 0.2 μL.

7. The print head of claim 1, wherein said print head comprises at least 4 spotting capillaries.

8. The print head of claim 1, wherein said print head comprises at least 16 spotting capillaries.

9. The print head of claim 1, wherein the spacing between two adjacent spotting capillaries is about 3 mm or less, center to center.

10. The print head of claim 1, wherein said the spotting capillaries have detents where said spotting capillaries have a rest position wherein said detents contact said

support stopping the movement of said spotting capillaries in a direction toward the substrate that is to be printed.

11. The print head of claim 1, wherein said print head comprises a spring attached to a spotting capillary where, in the absence of a force against the printing tip of said spotting capillary said spring returns said spotting capillary to a rest position.

12. The print head of claim 1, wherein said print head is in a microarray printing device.

13. The print head of claim 1, wherein said capillaries are in fluid communication with a manifold.

14. The print head of claim 32, wherein said manifold comprises a common port and individual ports wherein an aperture into an individual port is disposed inward of the inside wall of said manifold.

15. A platen for positioning a substrate holder or a print head in a microarray printing device, said platen comprising:

a support surface attached to a single guide rail such that said support surface can move along said guide rail, and motion of said support is constrained in a direction normal to said guide rail; and

a flexible coupling to an actuator wherein said flexible coupling is rigid in a direction parallel to said guide rail, but is flexible in another direction.

16. The platen of claim 15, wherein said platen comprises an encoder that encodes the position of said platen along said guide rail.

17. The platen of claim 16, wherein said encoder is an optical encoder.

18. The platen of claim 16, wherein said encoder is a magnetic encoder.

19. The platen of claim 16, wherein said encoder is a electronic encoder.

20. The platen of claim 15, wherein said platen is attached to said rail by two bearings.

21. The platen of claim 15, wherein said flexible coupling is a flexible sheet coupling.

22. The platen of claim 21, wherein said flexible sheet coupling is a sheet metal coupling.

23. The platen of claim 15, wherein said flexible coupling is a rod bearing.

24. The platen of claim 15, wherein said flexible coupling is a ball bearing.

25. The platen of claim 15, wherein said actuator is a stepping motor.

26. The platen of claim 15, wherein said actuator is a linear motor.

27. The platen of claim 15, wherein said platen further comprises a holder for a microarray substrate.

28. The platen of claim 27, wherein said holder is a slide holder.

29. The platen of claim 15, wherein said platen has attached thereto a microarray print head.

30. The platen of claim 29, wherein said print head is a print head of any one of claims 1 through 12.

31. A microarray printing device, said microarray printing device comprising:

a microarray print head comprising a plurality of glass or quartz spotting capillaries disposed in a support that maintains a fixed spacing between said spotting capillaries and that permits the spotting capillaries to move in a direction parallel to the long axis of said capillaries; and

and a microarray substrate holder attached to a platen comprising:

a support surface attached to a single guide rail such that said support surface can move along said guide rail, and motion of said support is constrained in a direction normal to said guide rail; and

a flexible coupling to an actuator wherein said flexible coupling is rigid in a direction parallel to said guide rail, but is flexible in another direction.

32. The microarray printing device of claim 31, wherein said printing device can print at least 5,000 array elements per spotting capillary per load.

33. The microarray printing device of claim 31, wherein said printing device can print array elements with a precision of at least 30 μm.

34. The microarray printing device of claim 31, wherein said printing device can print array elements with an average inter-element spacing 130 μm or less.

35. The microarray printing device of claim 31, wherein said platen is a platen of any one of claims 16 through 26.

36. The microarray printing device of claim 31, wherein said print head is a print head of any one of claims 2 through 14.

37. The microarray printing device of claim 31, wherein said print head is attached to a platen of any one of claims 16 through 26.

38. The microarray printing device of claim 31, wherein said microarray printer utilizes pressure and vacuum to control reagent loading or dispensing.

39. The microarray printing device of claim 31, wherein the spotting capillaries are in fluid communication with a manifold.

40. The microarray printing device of claim 39, wherein said manifold comprises a common port and individual ports wherein an aperture into an individual port is disposed inward of the inside wall of said manifold.

41. The microarray printing device of claim 31, wherein said device can print more than 200 microarray substrates in a run.

42. The microarray printing device of claim 31, wherein said device loads reagents from a microtiter plate comprising at least about 864 wells.

43. The microarray printing device of claim 31, wherein said device comprises means for applying positive or negative pressure to the spotting capillaries.

44. A method of printing a microarray, said method comprising:

providing an array substrate in a microarray printing device of any one of claims 31 through 44;

providing a series of solutions comprising the reagents that will form features of said microarray; and

operating said microarray printing device to print said microarray.

45. The method of claim 44, wherein said microarray printing device prints a microarray comprising at least 1,000 different array elements.

46. The method of claim 44, wherein said microarray printing device prints a microarray comprising having an average inter-feature spacing of no more than about 130 μm.

47. The method of claim 44, wherein said microarray is a nucleic acid microarray.

48. The method of claim 44, wherein said microarray is a protein microarray.

49. The method of claim 44, wherein said microarray is a small organic molecule microarray.

50. The method of claim 44, wherein said substrate is a glass substrate.

51. The method of claim 44, wherein said substrate is a metal-coated glass substrate.

52. The method of claim 44, wherein said microarray printing device applies negative pressure to load a spotting capillary.

53. The method of claim 44, wherein said microarray printing device applies positive pressure to dispense from a spotting capillary.

54. The method of claim 44, wherein said method comprises loading feature-forming reagents from a microtiter plate comprising at least about 864 wells.

55. A protein or nucleic acid microarray, said microarray comprising at least 1000 different array elements on an array substrate, said array elements comprising a protein or nucleic acid wherein

said array elements are separated by an average center to center spacing of about 130 μm or less; and

said protein or said nucleic acid is not a chemically synthesized protein or nucleic acid.

56. The microarray of claim 55, wherein said microarray is a nucleic acid microarray.

57. The microarray of claim 56, wherein the nucleic acids comprising said microarray have an average length greater than 500 nucleotides.

58. The microarray of claim 55, wherein said microarray is a protein microarray.

59. The microarray of claim 55, wherein said protein or nucleic acid is adsorbed to said substrate.

60. The microarray of claim 55, wherein the features comprising said array are at an average center to center spacing of about 100 μm or less.

61. The microarray of claim 55, wherein the features comprising said array are at an average density of about 40,000/cm^2 or greater.